[研究活動]研究トピックス : A Model of Reconnection Triggered Downflows in Quiescent Prominences

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A Model of Reconnection Triggered Downflows in Quiescent Prominences

The Hinode satellite, taking full advantage of the seeing free environment of space, has provided high resolution observations of supersonic bright downflows in quiescent prominences, known as prominence knots. These knots are impulsively acellerated whilst simultaneously showing increases in intensity.

The results of this work on knot acceleration are separated into two sections: the observational anaylsis and the simulation results. The observations are in the Ca II H spectral line using Solar Optical Telescope on board the Hinode satellite and show a descending plasma knot of size $\sim 900\,\mathrm{km}$. The knot initially undergoes ballistic motion before undergoing impulsive accelerations at the same time as experiencing increases in intensity. We also present a subset of our 3D magnetohydrodynamic (MHD) simulations, performed to investigate the nonlinear stability of the Kippenhahn-Shlüter prominence model to the magnetic Rayleigh-Taylor instability, in which interchange reconnection occurs. The interchange reconnection in the model breaks the force balance along the field lines which initiates the downflows. The downflows propagate with a downward fluid velocity of $\sim 15\,\mathrm{km\,s^{-1}}$ and a characteristic size of $\sim 700\,\mathrm{km}$. We conclude that the observed plasma blob and the simulated downflow are driven by the breaking of the force balance along the magnetic field as a result of a change in magnetic topology caused by reconnection of the magnetic field.

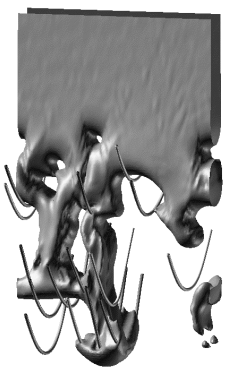

図: 3D rendering of the simulation of a reconnection triggered downflow in a prominence (see blob at the bottom of the image). The gray surface shows the density surface and the lines trace the magnetic field lines.

Reference:
Hillier, A., Isobe, H., Shibata, K., & Berger, T. 2012, ApJ, 756, 110.

(Andrew Hillier 記)